

# Use of Stable Isotopes to Trace the Fate of Applied Nitrogen in Forest Plantations

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## OBJECTIVES

*Improve the understanding of nitrogen (N) cycling in forest plantation ecosystems after fertilization*

- Determine the fate of <sup>15</sup>N applied in N containing fertilizers to mid-rotation loblolly pine plantations
- Compare N cycling among conventional and enhanced efficiency N fertilizers

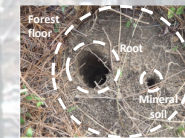
## PLOT DESIGN & LAYOUT

- (20) sites established within loblolly pine plantation range
  - Located in stands with current or historic research
- (5) Plots per site
  - 100 m<sup>2</sup> (0.02471 acres), 5.64 m radius
  - Tree densities similar among plots (+/- 1 tree)
- Plot center between 2 trees with similar crown class and DBH (co-dominant)
- Plots a minimum of 100 feet apart and from existing-historic research plots
- The installation of individual plots serves as replication across the region



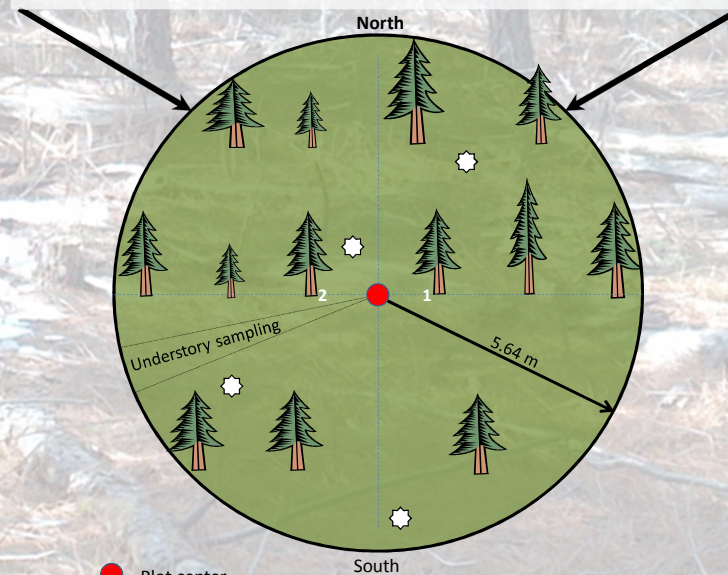
## PLOT MEASUREMENTS – Initial (T<sub>0</sub>) and Final (T<sub>post</sub>)

- Tree heights and DBH (all trees within plot)
  - Foliage from upper 1/3<sup>rd</sup> of crown from 2 central trees
  - Forest floor (FF) (0.25m<sup>2</sup>)
  - Mineral soil (0-15; 15-30 cm)
  - Roots
  - Litter – (2) per plot
- 1 sample per quadrant, composited



## SITE LOCATIONS & CHARACTERISTICS

Site	State	Physiographic Province	Soil Types
FL Pinemap	FL	Eastern Gulf Coast Flatwoods	Melvina-Moriah-Lutterloh
GA Pinemap	GA	Southern Piedmont	Davidson
OK Pinemap	OK	Upper Coastal Plain	Muskogee, Ruston
VA Pinemap	VA	Southern Piedmont	Spears Mountain-Littlejoe
18-0101	SC	Carolina Sand Hills	Lakeland
18-3102	LA	Western Gulf Coast Flatwoods	Corrigan-Kisatchie-Rayburn-Mayhew
18-1503	TX	Western Coastal Plain	Kurth-Rosenwall-Keltys
18-4201	GA	Atlantic Coast Flatwoods	Seagate
18-4202	GA	Atlantic Coast Flatwoods	Pelham
19-3101	LA	Western Gulf Coast Flatwoods	Malbis
98-0801	NC	Atlantic Coast Flatwoods	Leaf-Lynchburg
98-3501	AR	Arkansas River Alluvium	Henry-Calloway-Grenada
98-3901	AL	Southern Coastal Plain	Montevallo-Nauvoo
98-4001	SC	Atlantic Coast Flatwoods	Byars-Lumbee-Paxville
98-4201	AL	Southern Coastal Plain	Arundel
98-5501	VA	Southern Piedmont	Littlejoe
WGCD 08	LA	Southern Coastal Plain	Gilbert-Brimstone-Satsuma
WGCD 09	MS	Southern Coastal Plain	McLaurin-Lucy



- = Plot center
- 1, 2 = Co-dominant central trees
- ★ = Forest Floor, mineral soil, root sampling (randomized locations)

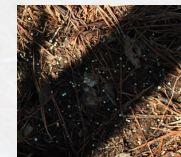
## BIOMASS HARVEST

- Winter 2011 & 2012
- (1) Tree destructively sampled per plot
- Entire above ground biomass of tree weighed in field
  - bole, branches, foliage
- Sample (cookie) taken from bole at DBH, base of live crown, and mid live crown
- Subsample of foliage and branches analyzed for <sup>15</sup>N



## FERTILIZATION OF PLOTS

- 5744 g of <sup>15</sup>N applied to (4) plots at each site
  - Control (No fertilizer)
  - Urea
  - Polymer coated urea (Agrium ESN)
  - NBPT treated urea (Agrotain Ultra)
  - MAP coated urea + NBPT (Arborite EC)
- 3 application periods
  - Late winter – March 2011
  - Early summer – June 2011
  - Late winter – March 2012 (14 sites)



## ADDITIONAL <sup>15</sup>N SAMPLING

- N Volatilization (2011)
- Seasonal foliage N Uptake (2011)
- Herbaceous (understory) stratum (2011-2012)
- Hardwood species (1" DBH class, dominant species) (2011-2012)

